A SURVEY OF ARTHROPODS ASSOCIATED WITH GOPHER TORTOISE BURROWS IN MISSISSIPPI[1]

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ABSTRACT: A survey of arthropods associated with gopher tortoise burrows in Mississippi revealed the presence of seven burrow commensals: *Chelyoxenus xerobatis* (Coleoptera; Histeridae); *Aphodius troglodytes* and *Onthophagus polyphemi sparsisetosus* (Coleoptera: Scarabaeidae); *Philonthus gopheri* (Coleoptera: Staphylinidae); *Eutrichota* sp. (Diptera: Anthomyiidae), *Machimus* n. sp. (Diptera: Asilidae) and *Amblyomma tuberculatum* (Acari: Ixodida: Ixodidae). *Eutrichota* sp. ranked first in abundance, followed by *P. gopheri, O. polyphemi sparsisetosus* and *Machimus* n. sp. (although the primary sampling method, a vacuum apparatus, biased abundance data in favor of surface dwellers within burrows). An additional 24 species were considered to be opportunists in the burrows, and seven more were apparently accidental. Among the non-commensals were 20 species of Coleoptera, five Hymenoptera, two Orthoptera, two Lepidoptera and two Diptera.

The gopher tortoise (*Gopherus polyphemus* Daudin) is a large, terrestrial turtle endemic to the southeastern United States, including southeastern Mississippi. Except when foraging during mornings and late afternoons of spring, summer and autumn months, the reptiles spend most of their time within burrows they construct in sandy soil. These burrows are usually rather simple, but may exceed seven meters in length (Hansen, 1963), and are used for several years. The relative permanency of the burrows, coupled with the presence of unique resources (tortoise dung, in particular) has resulted in the evolution of a unique fauna of vertebrates and invertebrates that reside with the tortoise.

Arthropods comprise a major part of the gopher tortoise burrow fauna and this group has received considerable attention in the past. Most work done with this interesting assemblage, however, has been conducted in Florida, and records for other areas are few and scattered. Franz and Bryant (1982) summarized much information on tortoise - habitat relationships and included a section entitled "Arthropods of Gopher Burrows" (Woodruff, 1982a). A list of 39 species of arthropods associated with burrows in Florida was presented along with notes on presumed relationships (obligates, accidentals, etc.). Mistrey (1987) presented a considerably longer list (267 + species) and included much information on biology of Florida burrow arthropods. He classified burrow inhabitants as: a) commensals: obligate inquilines, basically restricted to the habitat provided by their host, b) opportunists: species

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using the burrow for cover, or feces for food, but found commonly in other habitats, or consuming other types of feces and c) accidentals: species normally occurring in other habitats and not regularly using burrow resources.

The burrow commensals are generally coprophagous, parasitic on the tortoises, or predaceous primarily on other burrow arthropods. As is true for any organisms with very narrow habitat requirements, any major change in habitat availability could have devastating effects on the species involved. The status of the gopher tortoise varies from threatened to endangered throughout its range; consequently, the status of the obligate burrow inquilines is generally considered threatened or endangered (Woodruff, 1982b), and with obvious good reason.

Howden and Cartwright (1963) described a new subspecies of coprophagous scarab, *(Onthophagus polyphemi sparsisetosus)*, collected from gopher tortoise burrows in Alabama, Florida and Mississippi. The Mississippi specimens, collected 6.5 miles south of Lucedale, George County, represent the only known record for a tortoise burrow inquiline from the state. A primary reason for the lack of records would appear to be lack of collecting effort. Recently (1983) Andrew F. Beck (pers. commn.) used a modified vacuum to sample several burrows in Harrison County. Also in 1983, I excavated two burrows in Harrison and George counties, and throughout the early 1980's, set pit traps and blacklight traps in areas with good gopher tortoise populations. No burrow inquilines were collected during any of the above activity. The only insect specimens I examined that were in any way associated with tortoises in Mississippi was a series of beetles taken from tortoise droppings at the mouth of a burrow in Jones County, 21 August, 1985, by Robert Jones and Jerry Watkins. Three species were represented: *Myrmecaphodius excavaticollis* (Blanchard) (2 specimens) is an inquiline in fire ant nests and is not coprophagous. Its presence in this series is accidental. *Ataenius platensis* (Blanchard) (53 specimens) was considered to be accidental in tortoise burrows in Florida by Woodruff (1982a), but the presence of so many in this series would seem to indicated a more meaningful relationship, and this will be discussed later. The final specimen in the series was *Ataenius cylindrus* Horn, a species normally associated with cattle dung (Woodruff, 1973), and one that is not very common in Mississippi.

Recently there has been increased interest in "non-game" species by state departments of wildlife conservation, in particular those species that may be threatened or endangered. The above-mentioned *Onthophagus* was appropriately placed on the Mississippi list of species of special concern, and during 1987, I conducted a status survey of *O.*

polyphemi sparsisetosus in conjunction with a general survey of the arthropod fauna of gopher tortoise burrows in the state.

METHODS

The most obvious problems encountered during this study were: 1) finding active tortoise burrows, and 2) sampling the arthropod fauna within the burrows. The first problem proved not as difficult as originally anticipated. There is great interest in the status of Mississippi gopher tortoise populations among herpetologists and other wildlife biologists in the state. Several surveys, both formal and informal, have been conducted (e.g. Lohoefener, 1982) and much of this information has been compiled by the Mississippi Natural Heritage Program. The information provided by the Heritage Program included localities of supposedly active burrows in all counties where the tortoise is known to occur. Additionally, Harry Pawelczyk provided information on populations within the DeSoto National Forest and several individuals assisted by taking me to burrows of which only they had knowledge. Although the information provided by the Heritage Program and Pawelczyk was invaluable in finding localities, the majority of actual field time was spent making transects through the areas in an attempt to find active burrows. Specific localities were chosen on the basis of success potential (large numbers of active burrows) and on the basis of distribution (in all counties within the range of the tortoise, including localities near the margin of that range to get the broadest picture of the distribution of arthropods encountered).

Samples were collected from burrows using a gas-powered leaf blower that had been modified into a vacuum. An adapter, with an in-line filter, was added to the air intake of the blower and a 1.25 inch diameter, smooth bore vacuum hose attached. A 30-foot hose enabled sampling of even the longest burrows. The procedure involved snaking the hose into a burrow, attaching the hose to the vacuum, then slowly extracting the hose with a twisting motion. The in-line filter caught debris and any arthropods, while allowing sand to pass through. The filter was then removed, its contents placed in an enamel pan and the athropods collected. This method of extraction has proven to be very efficient in sampling burrows in Florida (A.F. Beck, pers. comm.; E.G. Milstrey, pers. comm.), and is certainly less labor intensive than burrow excavation. (It should be noted that excavation of burrows has not been allowed since gopher tortoises were placed on the Mississippi list of endangered species.) Many additional specimens were obtained by examining tortoise feces found around burrow openings. Occasionally, pit traps baited with fresh tortoise feces were set near burrows. Blacklight

traps were run in several colonies in an attempt to capture specimens of *Copris gopheri* Hubbard and *Aphodius troglodytes* Hubbard, burrow inquilines occasionally attracted to light (Woodruff, 1973). A total of 21 days was spent searching for and sampling burrows from 7 May through 24 June, 1987. Voucher specimens have been placed in the insect collection of the University of Mississippi.

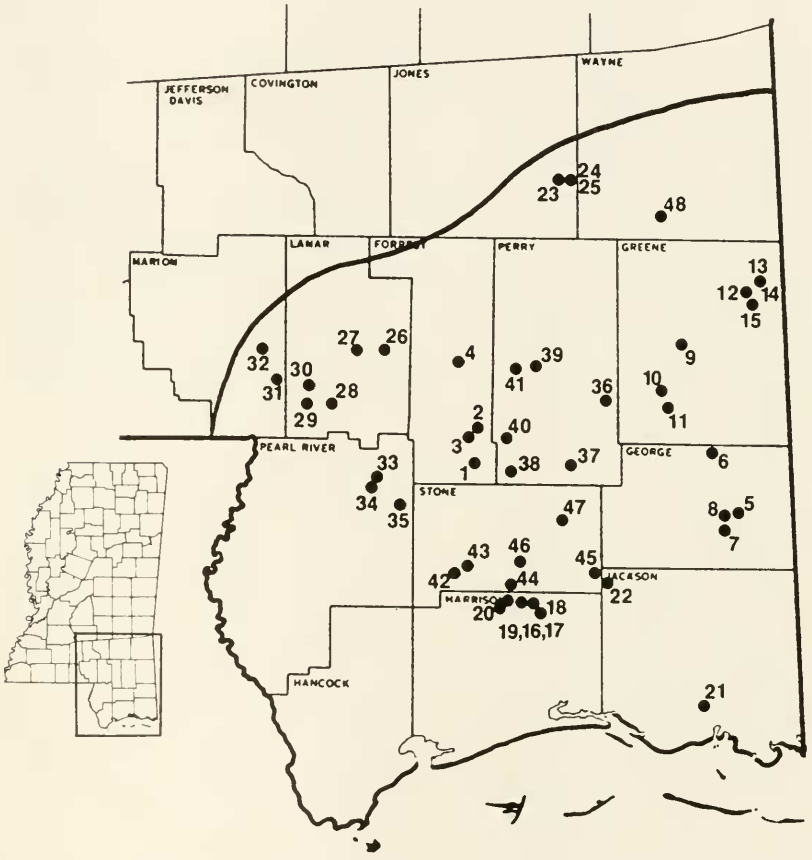

Figure 1. Distribution of collecting localities within the approximate range of the gopher tortoise in Mississippi.

RESULTS AND DISCUSSION

During this study, light trapping was ineffective in capturing burrow inquilines. Although pit trapping did yield a few specimens of coprophagous species, no inquilines were collected using this method. The vacuum method, however, was quite successful in capturing both inquilines and other burrow inhabitants, and unless otherwise indicated, comments below refer to specimens collected in this manner. Using the vacuum, samples were taken from 246 burrows at 48 localities in 12 counties. Active burrows were not found in Hancock county, but historically tortoises are not common here (R. Lohoefener, pers. comm.). Burrows were sampled in all other counties where tortoises occur in Mississippi (Fig. 1). Table 1 presents locality data and the number of burrows sampled at each site.

Table 1. Mississippi localities where active gopher tortoise burrows were sampled for inquilines.

County	Loc. No.	Locality	Burrows Sampled
Forrest	1	7.5 mi. S Brooklyn	1
Forrest	2	1.5 mi. SE Brooklyn	8
Forrest	3	2.5 mi. SSE Brooklyn	2
Forrest	4	2 mi. S McLaurin	4
George	5	6.5 mi. SE Lucedale	5
George	6	5 mi. N Lucedale	1
George	7	7 mi. SSE Lucedale	10 (two dates)
George	8	6 mi. SE Lucedale	6
Greene	9	7.5 mi. NW Leakesville	3
Greene	10	10.5 mi. WSW Leakesville	5
Greene	11	10 mi. SW Leakesville	2
Greene	12	8 mi. S State Line	9
Greene	13	7.5 mi. S State Line	7
Greene	14	7.5 mi. S State Line	2
Greene	15	9.5 mi. S State Line	8
Harrison	16	5 mi. ENE Saucier	2
Harrison	17	6 mi. ENE Saucier	1
Harrison	18	7 mi. E Saucier	1
Harrison	19	3.5 mi. NE Saucier	9 (two dates)
Harrison	20	3.5 mi. NE Saucier	6
Jackson	21	3 mi. N Gautier, Sandhill Crane National Wildlife Refuge	3
Jackson	22	16 mi. NE Vancleave	1

County	Loc. No.	Locality	Burrows Sampled
Jones	23	13 mi. ESE Ellisville	11
Jones	24	14 mi. ESE Ellisville	5
Jones	25	14 mi. ESE Ellisville	5
Lamar	26	1.1 mi. NNE Purvis	7
Lamar	27	3.5 mi. WNW Purvis	1
Lamar	28	5.5 mi. NWLumberton	6
Lamar	29	0.7 mi. S Baxterville	5
Lamar	30	1.3 mi. N Baxterville	2
Marion	31	13.5 mi. SE Columbia	6
Marion	32	10 mi. SE Columbia, Marion Co. Wildlife Management Area	12
Pearl River	33	9 mi. NE Poplarville	2
Pearl River	34	9 mi. NE Poplarville	6
Pearl River	35	11 mi. ENE Poplarville	9 (two dates)
Perry	36	8.5 mi. ESE Beaumont	1
Perry	37	16.5 mi. S. Beaumont	2
Perry	38	4.5 mi. NE Fruitland Park	6
Perry	39	4 mi. SW New Augusta	9
Perry	40	6 mi. SW New Augusta	5
Perry	41	14.5 mi. SSW New Augusta	5
Stone	42	3.5 mi. WNW McHenry	4
Stone	43	4.5 mi. WNW McHenry	2
Stone	44	9 mi. SE Perkinston	7 (two dates)
Stone	45	15.5 mi. ESE Perkinston	5
Stone	46	6.5 mi. ESE Perkinston	1
Stone	47	11.5 mi. E Wiggins	5 (two dates)
Wayne	48	16.5 mi. SW Waynesboro	13

Milstrey (1986) discussed various collecting techniques used to sample burrow arthropods, and concluded that the vacuum method was most efficient for sampling large numbers of burrows in a short time with the least amount of habitat disturbance. Certain disadvantages of the method are obvious: no direct observation of behavior is possible, there is no real control over the amount of burrow surface sampled, and strong fliers (Diptera, Hymenoptera) may escape the airstream or very small specimens be sucked through the inline filter (Milstrey, 1986). In addition, the vacuum collects primarily from the burrow surface and insects that tunnel in the floor of the burrow (such as some dung beetles) may be protected from the hose. Consequently, this method provides data that, at best, indicates relative abundance for burrow surface dwellers, but presence only for burrowers.

Representatives of 37 species in 11 families and five orders of insects, and one species of tick were collected from tortoise burrows or tortoise feces during this study. In the following discussion of individual species, presumed relationships with the tortoise are indicated using the terms defined by Milstrey (1986): commensals, opportunists or accidentals (as discussed above). Admittedly, the distinction between opportunistic and accidental species, while obvious by definition, is somewhat subjective for rarely encountered species. Consequently, some classification changes may be necessary in the following list as additional information comes to light.

ANNOTATED LIST OF SPECIES

Coleoptera

Histeridae

Chelyoxenus xerobatis Hubbard. Commensal. Localities 5, 10, 12, 20, 26. 26 May - 24 June. Specimens collected - 5. This species burrows in the floor of tortoise galleries and is also found in tortoise feces (Hubbard, 1894; Young and Goff, 1939). The larvae are apparently predaceous on maggots feeding on tortoise dung (Hubbard, 1896). The five specimens collected were taken from widely scattered localities indicating a range co-extensive with that of its host. The small number of individuals collected may be explained by the burrowing habits of this species, or by the fact that it is simply not common in Mississippi. Burrow excavation would be necessary to determine if either or both of these statements is true.

Phelister rouzeti Fairmaire. Opportunist. Locality 24. 15 June. Specimens collected - 9. This small series was taken from fresh tortoise feces near the mouth of a burrow. The species was previously unknown east of the Mississippi River (R. Wenzel, pers. comm.)

Hydrophilidae

Cercyon pygameus Illiger. Opportunist. Locality 24. 15 June. Specimens collected - 1. Various species of *Cercyon,* including *C. pygmaeus*, are commonly found in dung (Smetana, 1978). This specimen was collected from fresh tortoise feces near the mouth of a burrow.

Scarabaeidae

Aphodius rubeolus (Beauvois). Accidental. Localities 29, 34. 21, 22 June. Specimens collected - 2. *Aphodius rubeolus* is common in a variety of types of feces in Mississippi, so the presence of only two specimens in burrow samples seems best described as accidental.

Aphodius stercorosus Melsheimer. Accidental. Locality 48. 24 May. Specimens collected - 1. The presence of this generalist dung beetle represents the same situation as *A. rubeolus*. Both species are very common here but neither was taken from readily available tortoise feces.

Aphodius troglodytes Hubbard. Commensal. Locality 48. 15 June. Specimens collected - 3. Adults and larvae of this species feed only on gopher tortoise feces (Woodruff, 1973). Although they are common in Florida burrows, specimens are most often found in the driest, sandiest areas (Milstrey, 1987). The single Mississippi location, in southern Wayne County, fits this description better than any other area visited during this study. All specimens were taken from one burrow. Since adults remain associated with tortoise feces (rather than burrowing), and since feces were often vacuumed from burrows, its appears the species is very rare in Mississippi, and has a range that is not co-extensive with that of its host.

Ataenius cylindrus Horn. Opportunist. Localities 12, 16, 21, 22, 25, 32, 36, 44, 47. 19 May - 24 June. Specimens collected - 20. Specimens were collected from tortoise feces, vacuumed from burrows and taken in a pit trap baited with fresh tortoise dung. This species occurs in cattle feces and must be considered an opportunist here, but the large number of specimens collected and the wide range of collection sites indicated that tortoise droppings may represent a preferred opportunity.

Ataenius fattigi Cartwright. Accidental. Locality 48. 15 June. Specimens collected - 1. Typically found in cattle feces, and fairly common in Mississippi, the presence of one specimen of *A. fattigi* in a vacuum sample is probably best described as accidental.

Ataenius ovatulus Horn. Opportunist. Localities 23, 32. 15 and 22 June. Specimens collected - 3. Virtually nothing is known of the biology of this rare species. Supposedly they do not use feces as a food source (Woodruff, 1973), but I have taken specimens in pit traps baited with human feces and, during this study, three specimens were collected from tortoise feces.

Ataenius platensis Blanchard. Opportunist. Localities 16, 21, 23, 24, 25. 15, 17 and 18 June. Specimens collected - 127. This is a common, wide ranging species that uses a variety of feces for food. Although Woodruff (1982a) considered this to be accidental in tortoise burrows, I collected 101 specimens from tortoise feces indicating a relationship better described as opportunistic. Although the majority of these specimens were taken from feces near the mouths of burrows, several were collected from fecal masses vacuumed from distal ends of burrows.

Onthophagus polyphemi sparsisetosus Howden and Cartwright. Commensal. Localities 2, 5, 7, 9, 15, 19, 23, 28, 29, 32, 47, 48. 9 May - 24 June. Specimens collected - 26. Adults feed on tortoise feces (Woodruff, 1973), but larval habits remain unknown. Since adult *Onthophagus*, in general, burrow and bury dung for larval food, it seems likely that the vacuum method did not give a good estimate of the relative abundance of this species. However, the 26 specimens ranked second only to *Philonthus gopheri* Hubbard (Staphylindae) among beetle commensals collected. The ranges of the beetle and the tortoise are coextensive in Mississippi. This was the only commensal collected outside burrows. One individual was observed flying into a burrow on a sunny day (about 2:00 pm, 80° F.). The beetle flew back and forth across the opening two or three times, each time flying less distance and moving closer to the hole, and finally landed about 20 cm into the burrow. A second specimen was found at the mouth of a burrow where it was being subdued by fire ants (*Solenopsis invicta* Buren).

Staphylinidae

Alenochora notula Erichson. Opportunist. Locality 24. 15 June. Specimens collected - 1.

Taken from tortoise feces at mouth of burrow.

Anotylus sp. Opportunist. Locality 24. 15 June. Specimens collected -5. Taken from tortoise feces at mouth of burrow.

Falgaria dissecta Erichson. Opportunist. Locality 24. 15 June. Specimens collected - 1. Collected with the preceding two species.

Gabronthus mgogoricus Tottenham. Opportunist. Localities 24, 29. 15, 21 June. Specimens collected - 5. Four specimens were taken from fresh tortoise feces near a burrow mouth, the fifth was vacuumed from a burrow.

Lithocaris sp. Opportunist. Locality 24. 15 June. Specimens collected - 1. Taken from tortoise feces near burrow.

Mycetoporus sp. Opportunist (?). Localities 3, 44. 8, 23 May. Specimens collected - 2. Both specimens were vacuumed from burrows.

Philonthus gopheri Hubbard. Commensal. Localities 7, 19, 27, 28, 32, 35, 37, 38, 39, 48. 7 May - 24 June. Specimens collected - 56. This was the most abundant of the coleopteran burrow commensals, and its range coincides with the tortoise's here. Woodruff (1982a) consolidated the scattered information on *P. gopheri,* but within that material there was no information as to the role of the species in the burrows.

Philonthus spp. Two species (35 specimens) were collected at location 24 from tortoise feces (15 June) and an additional species (1 specimen) at location 29 from a burrow (21 June). These are probably opportunistic predators.

Three additional unidentified species (6 specimens) within the Aleocharinae were collected from tortoise feces near the mouth of a burrow at location 24 (15 June). Probably opportunistic predators.

Since the majority of the specimens of staphylinids (not including *Philonthus gopheri*) were collected from tortoise feces, it seems logical that they were feeding on organisms there and that they should be considered opportunists. However, most were collected at the same locality (24) and from near the same burrow, unusual in the fact that it was shaded by a dense shrub. "Accidental" may better describe the relationship between any of these species and the gopher tortoise, but further observations are necessary.

Diptera

Anthomyiidae

Eutrichota sp., probably *E. gopheri* (Johnson). Commensal. Collected at all localities except 3, 6, and 18, throughout sampling period. Specimens collected - 75. It is estimated that less than 10% of the flies in vacuum samples were retained. A trip through the vacuum hose was fairly hard on these delicate individuals and confirmation of their identity awaits collection of good specimens of males. This was the most abundant commensal encountered. Adults dominated vacuum samples from most burrows and larvae were very common in fresh tortoise feces. The number of "specimens collected", which does not include larvae, greatly underestimates the number present in samples. When the in-line filter was

removed, most of the flies escaped. This was not considered to be a problem because several stunned individuals were usually present. Many in the filter were discarded because of damage caused by the vacuum ordeal. I suspect this species is the primary prey for most of the predatory burrow arthropods, but no act of predation was actually observed.

Asilidae

Machimus n.sp. Commensal. Localities 7, 28, 35, 45, 47, 48. 21 May - 22 June. Specimens collected - 14. S.W. Bullington has verified the identity of this robber fly as the species he and A.F. Beck are describing from tortoise burrows in Florida and Georgia. Adults roost on the roofs of burrows just inside the entrance (within 40 cm). Only under extreme harassment could they be forced to leave the burrow, and then they immediately reentered. Most specimens were collected while the vaccum hose was being withdrawn from a burrow. An assistant would stand near the entrance with an aerial net and capture specimens when they made their brief appearance. Only three specimens were collected with the vacuum. Although four specimens emerged from one burrow and three from another, one or two per burrow was the rule. Many more specimens were seen than were captured, including individuals at two localities not listed above. They were quicker than we. The range of the species here is co-extensive with that of the tortoise. According to Milstrey (1987), this robber fly is predaceous on the anthomyiid fly, *Eutrichota gopheri* (Johnson), another burrow commensal.

Dolichopodidae

Hercostomus sp. Accidental (?). Localities 8, 38, 48. 21 - 26 May. Specimens collected -3.

Sphaeroceridae

Rachispoda sp. Opportunist (?). Locality 44. 8 May. Specimens collected - 1.

Hymenoptera

Formicidae

All of the following species of ants are predaceous and are considered opportunistic burrow inhabitants. On one occasion, an individual of *Onthophagus polyphemi sparsisetosus* found at the mouth of a burrow was being attacked by many fire ants *(Solenopsis invicta)*. Although the beetle was still alive, it was incapable of coordinated movement. No other instance of ant predation in a burrow was observed.

Aphaenogaster rudis Emery. Localities 20, 35. 22, 24 June. Specimens collected - 5.

Cyphomyrmex rimosus (Spinola). Locality 44. 19 May. Specimens collected - 1.

Iridomyrmex pruinosus (Roger). Locality 3. 23 May. Specimens collected - 1.

Solenopsis invicta Buren. Localities 3, 10, 15, 20, 22, 23, 35, 48. 23 May - 24 June. Specimens collected - 18.

Pompilidae

Anoplius atrox (Dahlbom). Opportunist. Locality 28. 21 June. Specimens collected - 1. Although only one specimen was collected, individuals were observed exiting burrows at several locations. They left their roosting places on the burrow roofs just as the vacuum hose entered. In all instances, individuals were observed only in the first few burrows sampled in early morning (before 9:30 am) suggesting that the wasps use the burrows as overnight refuges.

Lepidoptera

This order was represented in the samples by two larvae, one a pyralid, the second, a tortricid. Neither was identified to genus. Nothing indicated other than an accidental occurrence for either.

Orthoptera

Blattellidae

Cariblatta lutea (Saussure and Zehnter). Locality 2. 23 May. Specimens collected - 1. The presence of one specimen of this common species in a burrow must be considered accidental.

Gryllacrididae

Ceuthophilus divergens Scudder. Opportunist. Localities 2, 7, 8, 9, 11, 12, 13, 15, 20, 23, 28, 31, 32, 35, 37, 38, 40, 41, 45, 47, 48. 9 May - 24 June. The second most abundant species encountered during this study, it has not been reported from tortoise burrows previously, although congeners are documented burrow inhabitants (Milstrey, 1987; Woodruff, 1982a). The vast majority of individuals were seen when they escaped burrows as the vacuum hose was removed; however, the inline filter usually contained a few salvageable specimens. Like the *Eutrichota* sp. mentioned previously, probably less than 10% of individuals seen were collected. This species occurs in various habitats (Dakin and Hayes, 1970); consequently, it must be considered an opportunist using the burrows for cover.

Acari: Ixodida

Ixodidae

Amblyomma tuberculatum Marx. Commensal. Localities 35, 48. 15 - 24 June. Specimens collected - 3 adults, 1 nymph. The large gopher tortoise tick was collected at only two localities during this study, and no specimens were found on the few tortoises examined. Population numbers peak in late October and November in Florida (Milstrey, 1987), and it is possible that had I collected later in the year, more individuals might have been found. Based on the distribution of collection localities, I suspect the range of the tick is coextensive with that of the tortoise here.

SUMMARY

During May and June, 1987, samples of arthropods were taken from

246 gopher tortoise burrows in southeastern Mississippi. Of the 38 species of arthropods represented in the samples, seven were true commensals, 24 were considered to be opportunistic and seven were probably accidental in occurrence. The commensals were *Chelyoxenus xerobatis* (Histeridae), *Aphodius troglodytes* and *Onthophagus polyphemi sparsisetosus* (Scarabaeidae), *Philonthus gopheri* (Staphylinidae), *Asilus* n.sp. (Asilidae), *Eutrichota* sp. (Anthomyiidae) and *Amblyomma tuberculatum* (Ixodidae). *Eutrichota* sp. ranked first in abundance among the commensals, followed by *P. gopheri, O. polyphemi sparsisetosus* and *Machimus* n.sp. With the exception of *Aphodius troglodytes*, the ranges of the commensals appear to coincide with the range of the gopher tortoise in Mississippi.

Most of the opportunistic species were beetles (18 species), along with five hymenopterans and one orthopteran. Five of the opportunists were coprophagous, 17 were predaceous and two appeared to be using the burrows for cover.

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ERRATA

In the Nov. - Dec. 1990 issue of *Entomological News,* there are two small errors in the article entitled "New Records of Mayflies (Ephemeroptera) from Maine" by Steven K. Burian and Ronald G. Mack (ENT. NEWS 101(5):297-300). These are corrected below:

On page 297, second paragraph, line seven and on page 299, first line, there should not be any parenthesis [( )] around Traver. These should both read: *Acentrella ampla* Traver.

On page 297, second paragraph, line eight, *Centroptilus* should read *Centroptilum.*

Both the editor and the authors apologize for these errors.